

PATENT COOPERATION TREATY

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NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents
United States Patent and Trademark
Office
Box PCT
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in its capacity as elected Office

| | |
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| Date of mailing (day/month/year) 14 September 1999 (14.09.99) | |
| International application No. PCT/GB98/03728 | Applicant's or agent's file reference J00040374WO |
| International filing date (day/month/year) 11 December 1998 (11.12.98) | Priority date (day/month/year) 12 December 1997 (12.12.97) |
| Applicant REYNOLDS, Paul et al | |

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:

07 July 1999 (07.07.99)

☐ in a notice effecting later election filed with the International Bureau on:2. The election ☒ was☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

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| The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35 | Authorized officer S. Mafla Telephone No.: (41-22) 338.83.38 |
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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

| | | |
|--|---|--|
| Applicant's or agent's file reference J00040374WO | FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416) | |
| International application No. PCT/GB98/03728 | International filing date (day/month/year) 11/12/1998 | Priority date (day/month/year) 12/12/1997 |
| International Patent Classification (IPC) or national classification and IPC H04Q7/38 | | |
| Applicant ORANGE PERSONAL COMMUNICATIONS SERVICES.. et al. | | |

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.



2. This REPORT consists of a total of 7 sheets, including this cover sheet.

- ☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☒ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☒ Certain observations on the international application

| | |
|---|--|
| Date of submission of the demand 07/07/1999 | Date of completion of this report 04.04.2000 |
| Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465 | Authorized officer Teiwes, J Telephone No. +49 89 2399 7504  |

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/GB98/03728

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

| | | | |
|-------------------------------|------|--------|------------|
| Novelty (N) | Yes: | Claims | 3-12,14-15 |
| | No: | Claims | 1,2,13,16 |
| Inventive step (IS) | Yes: | Claims | |
| | No: | Claims | 1-20 |
| Industrial applicability (IA) | Yes: | Claims | 1-20 |
| | No: | Claims | |

2. Citations and explanations

see separate sheet

VI. Certain documents cited

1. Certain published documents (Rule 70.10)

and / or

2. Non-written disclosures (Rule 70.9)

see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Re Item V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

- 1 The following document will be referenced:

D1: WO 95 17076 A (LUIJTEN GUIDO JOZEF HUIBERTUS ;NEDERLAND PTT (NL); NORP ANTONIUS H) 22 June 1995

D2: MOULY M ET AL: 'GSM System for Mobile Communications' 1993 , GSM SYSTEM FOR MOBILE COMMUNICATIONS, ROPE MEDIA, EU , MOULY M;PAUTET M-B XP002079506

- 2 The present application does not meet the requirements of Articles 33(1) and (2) PCT, because the subject-matter of claim 1 is not novel.

- 2.1 The present broad formulation of independent method claim 1 is such that its subject matter can be read onto prior art document D1, which relates to a mobile communication system.

In particular, document D1 discloses a method of transmitting signalling reports from a mobile station to a serving base station in a cellular communications network infrastructure and a plurality of base stations connected thereto (p.1, l.11-17). D1 further discloses the transmission of radio measurement reports intended for use by said serving base station to allocate a radio resource to said mobile station (p.1, l.19- 20). D1 further discloses the transmission of a radio resource signalling report intended for use by a service node in said network infrastructure to allocate a radio resource to said mobile station (p.3, l.7-22).

- 2.2 Independent method claim 2 differs from independent method claim 1 in that a radio resource signalling report is encapsulated to prevent the serving base station from intercepting said report. Such an encapsulation step is also disclosed by D1 (p.3, l.7- 14). Hence, claim 2 is not novel.

- 2.3 The additional features of dependent claim 3 to 10 are either known from the prior art or are common design possibilities. Hence, these claims are either not novel or

inventive.

D2 discloses that radio resource signalling reports and mobile-originating SMS messages are sent over the Slow Associated Control Channel (SACCH) (p.420, par.6.3.8; p.423, fig.6.40). Hence, it is obvious to encapsulate the reports in SMS messages. It is just a special form of having a signalling message with a destination code as disclosed by D1 (p.3, l.10-11). Hence, claim 3 does not add anything inventive to claim 1 or 2.

The features of dependent claim 4 "transmitting the report during a dedicated connection", is disclosed by D2 (p.420, para. 6.3.8 "When the mobile station is in dedicated mode,..."). Hence, claim 4 does not add anything inventive to claims 1 or 2.

The features of dependent claim 5 to 9 are well known in the art of mobile communications or are common design possibilities and do therefore not add anything inventive to claims 1 or 2.

Claim 10 does not add anything inventive to claim 1 or 2 due to lack of clarity (see VIII 3).

- 2.4 The subject matter of independent method claim 11 is the same as of claim 3 and does, therefore, not involve an inventive step.
- 3 The features of independent apparatus claim 12 correspond to the already discussed part of the method steps of method claims 1-11 which are employed by a mobile phone. Claim 12 does, therefore, not involve an inventive step.
- 4 The features of independent system claim 13 correspond to the already discussed method steps of independent claim 1 (D1, p.3, l.7-14). Claim 13 is, therefore, not novel.
- 4.1 The features of dependent claim 14 and 15 correspond to those of claim 5 and 8 respectively and do therefore not add anything inventive to claim 13.

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB98/03728

The feature of dependent claim 16 seems to be disclosed by D1 (p.3, l.7-22).
Hence, claim 16 does not add anything novel to claim 13.

The features of dependent claims 17-20 are common design possibilities and do
therefore not add anything inventive to claim 13.

Re Item VI

Certain documents cited

Certain published documents (Rule 70.10)

| Application No Patent No | Publication date (day/month/year) | Filing date (day/month/year) | Priority date (valid claim) (day/month/year) |
|-----------------------------|--------------------------------------|---------------------------------|---|
| EP 0 851 700 | 01.07.98 | 11.12.96 | |

The priority document of the application was not at available at the time of the preliminary examination. It is therefore assumed that the priority of the application is valid in consequence of which document EP 0 851 700 is not considered as prior art. Said assumption will be invalid if it turns out that the priority of the application is not valid and then the document could become relevant at a later stage.

Re Item VII

Certain defects in the international application

- 1 In order to fulfil the requirements of Rule 5.1(a)(ii) PCT, documents D1 and D2 should have been identified in the description and the relevant background art disclosed therein briefly discussed.
- 2 In order to meet the requirements of Rule 6.3(b) PCT the independent claim should have been cast in the two-part form, with those features which in combination are disclosed by document D1 being placed in a preamble, Rule 6.3(b)(i) PCT, and with the remaining features being included in a characterising part, Rule 6.3(b)(ii) PCT.

- 3 Reference signs placed in parentheses should have been inserted into all the claims to increase their intelligibility, Rule 6.2(b) PCT. This applies to both the preamble and the characterising portion.

Re Item VIII

Certain observations on the international application

- 1 The independent method claims 1, 2 and 11 do not meet the requirements of Article 6 PCT, because they lack conciseness.

The various definitions of the invention given in these independent claims are such that the claims as a whole are not concise, contrary to Article 6 PCT, in particular since the subject matter represented in the different claims overlaps to such an extent that they could have easily been formulated as a single independent claim and dependent claims as appropriate (see Rule 6.1(a) PCT and the PCT-Guidelines, chapter III-5.1).

- 2 Claim 10 is not clear because it is not known which user is meant here. Additionally, there is a lack of antecedence with "said user" because the user has not been introduced in any of the referenced claims 1 to 8.

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/GB98/03728

I. Basis of the report

1. This report has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.*):

Description, pages:

1-15 as originally filed

Claims, No.:

1-20 as originally filed

Drawings, sheets:

1/3-3/3 as originally filed

2. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
☐ the claims, Nos.:
☐ the drawings, sheets:

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

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INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

| | | |
|--|---|--|
| Applicant's or agent's file reference J00040374W0 | FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below. | |
| International application No. PCT/GB 98/ 03728 | International filing date (day/month/year) 11/12/1998 | (Earliest) Priority Date (day/month/year) 12/12/1997 |
| Applicant ORANGE PERSONAL COMMUNICATIONS SERVICES.. et al. | | |

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 2 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing:

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

☐ the text is approved as submitted by the applicant.

☒ the text has been established by this Authority to read as follows:

METHOD FOR TRANSMITTING MEASUREMENT REPORTS IN A MOBILE COMMUNICATIONS SYSTEM

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

☒ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

4

☐ None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 98/03728

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04Q7/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category ° | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|------------|---|------------------------------|
| X | MOULY M ET AL: "GSM System for Mobile Communications" 1993 , GSM SYSTEM FOR MOBILE COMMUNICATIONS, ROPE MEDIA, EU , MOULY M;PAUTET M-B XP002079506 see page 264 - page 266 see page 284 - page 287 see page 420 - page 423 --- | 1-20 |
| X | WO 95 17076 A (LUIJTEN GUIDO JOZEF HUIBERTUS ;NEDERLAND PTT (NL); NORP ANTONIUS H) 22 June 1995 see page 3, line 1 - page 5, line 21 see page 15, line 1 - page 20, line 20 --- | 2,7-9, 12,13, 15-17,19 |
| P,X | EP 0 851 700 A (HEWLETT PACKARD CO) 1 July 1998 see column 5, line 49 - column 6, line 27 ----- | 1-20 |

☐

Further documents are listed in the continuation of box C.

☒

Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

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Date of the actual completion of the international search

22 April 1999

Date of mailing of the international search report

04/05/1999

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Kokkoraki, A

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 98/03728

| Patent document cited in search report | | Publication date | Patent family member(s) | Publication date |
|---|---|---------------------|----------------------------|---------------------|
| WO 9517076 | A | 22-06-1995 | NL 9302170 A | 03-07-1995 |
| | | | AT 167017 T | 15-06-1998 |
| | | | AU 680089 B | 17-07-1997 |
| | | | AU 1313795 A | 03-07-1995 |
| | | | CN 1142880 A | 12-02-1997 |
| | | | DE 69410824 D | 09-07-1998 |
| | | | DE 69410824 T | 19-11-1998 |
| | | | EP 0734634 A | 02-10-1996 |
| | | | ES 2118550 T | 16-09-1998 |
| | | | GR 3027718 T | 30-11-1998 |
| | | | JP 9500510 T | 14-01-1997 |
| <hr/> | | | | |
| EP 0851700 | A | 01-07-1998 | NONE | |
| <hr/> | | | | |



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

| | | | |
|---|--|--|---|
| (51) International Patent Classification ⁶ : H04Q 7/38 | | A1 | (11) International Publication Number: WO 99/31918 |
| | | | (43) International Publication Date: 24 June 1999 (24.06.99) |
| (21) International Application Number: PCT/GB98/03728 | | (81) Designated States: AL, AM, AT, AT (Utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), EE, EE (Utility model), ES, FI, FI (Utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (Utility model), SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). | |
| (22) International Filing Date: 11 December 1998 (11.12.98) | | | |
| (30) Priority Data: 9726362.8 12 December 1997 (12.12.97) GB | | | |
| (71) Applicant (for all designated States except US): ORANGE PERSONAL COMMUNICATIONS SERVICES LIMITED [GB/GB]; St. James Court, Great Park Road, Almondsbury, Bristol BS12 4QJ (GB). | | | |
| (72) Inventors; and | | | |
| (75) Inventors/Applicants (for US only): REYNOLDS, Paul [GB/GB]; Orange Personal Communications Services Limited, St. James Court, Great Park Road, Almondsbury, Bristol BS12 4QJ (GB). HOPE, Stephen [US/US]; Orange Personal Communications Services Limited, St. James Court, Great Park Road, Almondsbury, Bristol BS12 4QJ (US). | | | |
| (74) Agents: SPAARGAREN, Jerome et al.; R.G.C. Jenkins & Co., 26 Caxton Street, London SW1H 0RJ (GB). | | | |

Published

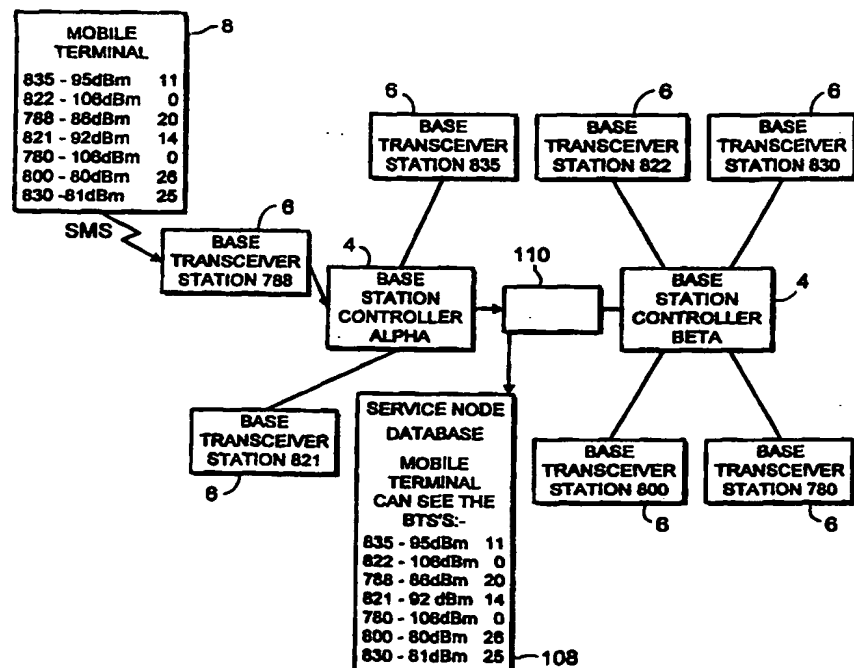
With international search report.

Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: METHOD FOR TRANSMITTING MEASUREMENT REPORTS IN A MOBILE COMMUNICATIONS SYSTEM

(57) Abstract

A service node is provided in a mobile communications network which collects radio link measurement reports which are transmitted to the service node by mobile stations. The mobile stations transmit the measurement reports in encapsulated form, in the form of SMS messages, in order to prevent the interception of the measurement report by the serving base station. The service node is able to perform handover decision algorithms using the measurement reports collected from the mobile stations in order to determine appropriate radio access nodes to be allocated to the mobile stations.



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METHOD FOR TRANSMITTING MEASUREMENT REPORTS IN A MOBILE COMMUNICATIONS SYSTEM

This invention relates to mobile communications, in particular to the transmission of radio resource signalling reports from mobile stations in a cellular communications system, and to the handling thereof within the system.

In known mobile communications systems, such as the GSM (Global System for Mobile communications), it is known for mobile stations to take radio link measurements during progress of a call, and to report these measurements to the serving base station. The base station uses these downlink measurement reports in order to determine when a handover is required.

Handover is initiated by the base station using radio sub-system criteria (signal strength level, link quality, link distance, etc) as well as network directed criteria (e.g. current traffic loading per cell, maintenance requests, etc).

In addition, current networks such as GSM networks include a mobile switching centre (MSC), a second generation component in the form of a large, central switch.

Third generation systems are proposed in which various levels of service are provided and in which the MSC functionality is provided in a distributed processing environment, rather than in the form of a central switch.

It would be desirable to provide a more flexible and sophisticated approach to radio resource allocation. It would also be desirable to provide for the re-use of existing mobile network elements, in particular base stations, whilst providing enhanced radio resource signalling functionalities.

5 In accordance with one aspect of the invention there is provided a method of transmitting signalling reports from a mobile station to a serving base station in a cellular communications system comprising a network infrastructure and a plurality of base stations connected thereto, said method comprising transmitting radio measurement reports intended for use by said
10 serving base station to allocate a radio resource to said mobile station, and transmitting a radio resource signalling report intended for use by a service node in said network infrastructure to allocate a radio resource to said mobile station.

This aspect of the invention allows radio resources to be allocated by
15 the serving base station when appropriate, whilst also allowing radio resources to be allocated by a service node higher in the network hierarchy in other circumstances. This prevents excessive signalling load in the network, whilst allowing additional parameters not available to the base station to be taken into account when allocating radio resources in these other circumstances.

20 In accordance with a further aspect of the invention there is provided a method of transmitting signalling reports from a mobile station to a cellular communications system comprising a plurality of base stations including a

base station serving said mobile station via a radio link, said method comprising encapsulating a radio resource signalling report before transmission over said radio link, such as to prevent said serving base station from intercepting said radio resource signalling data.

5 This aspect of the invention provides a method whereby radio resource signalling reports may be transmitted transparently through the serving base station, and onwards to further elements in the system. The encapsulation is preferably by means of a mobile-originating SMS message, which allows existing radio interface functionality to be used to conceal the radio resource
10 signalling report from the base station.

 In accordance with a yet further aspect of the invention there is provided a cellular communications system comprising a plurality of base stations for conducting communications with mobile stations via a radio interface, and a service node for collecting radio resource signalling reports
15 generated by mobile stations when in connected mode in said system, said system comprising means for receiving said reports from said plurality of base stations and for routing same to said service node.

 This aspect of the invention provides for the collection and use of radio resource-related data at the service node, to allow radio resource
20 allocation to be conducted by said service node on the basis of such radio resource signalling reports. For example, the service node may perform handover decision algorithms on the basis of the data contained in the radio

resource signalling reports, along with other data such as data specifying bandwidth, cost and/or quality of service requirements for the mobile stations.

Preferred embodiments of the invention will now be described with reference to the accompanying drawings, wherein:

5 Figure 1 is a schematic block diagram of a prior art mobile communications network;

 Figure 2 is a schematic block diagram of a mobile station for use in relation to the present invention;

 Figure 3 is a schematic block diagram of a mobile communications
10 system in accordance with the present invention; and

 Figure 4 is a schematic diagram illustrating functionality provided in accordance with the present invention.

 A GSM network, referred to as a public land mobile network (PLMN), is schematically illustrated in Figure 1. This is in itself known and will not be
15 described in detail. A mobile switching centre (MSC) 2 is connected via communication links to a number of base station controller (BSCs) 4. The BSCs 4 are dispersed geographically across areas served by the mobile switching centre 2. Each BSC 4 controls one or more base transceiver stations (BTSs) 6 located remote from, and connected by further
20 communication links to, the BSC. Each BTS 6 transmits radio signals to, and receives radio signals from, mobile stations 8 which are in an area served by that BTS. That area is referred to as a "cell". A GSM network is provided

with a large number of such cells, which are ideally contiguous to provide continuous coverage over the whole network territory. Indeed, a number of GSM networks may operate in the same areas to provide overlapping coverage.

5 The mobile switching centre 2 is also connected via communications links to other mobile switching centres in the remainder of the mobile communications network 10, and to other networks such as a public service telephone network (PSTN), which is not illustrated. The mobile switching centre 2 is provided with a home location register (HLR) 12 which is a
10 database storing subscriber authentication data including the international mobile subscriber identities (IMSI) which are unique to each mobile station 8. An IMSI consists of a mobile country code (3 decimal digits), a mobile network code (2 decimal digits) and a mobile subscriber code (up to 10 decimal digits) identifying a subscriber within a particular network. The IMSI
15 is also stored in the mobile station in a subscriber identity module (SIM) (to be described below) along with other subscriber-specific information.

 The mobile switching centre is also provided with a visitor location register (VLR), not shown, which is a database temporarily storing subscriber authentication data for mobile stations active in its area.

20 In addition, the MSC is connected to a short message centre (SMC) 14 for handling the transfer of short messages addressed to and from mobile stations within the network. The short message service (SMS) is a point-to-

point message service as specified in GSM Technical Specification 03.40. A user of a mobile station 8 may generate a mobile-originating SMS message by input to a Man Machine Interface (MMI) (e.g. a keypad) of the mobile station 8, and transmit the message, along with a destination address, to the servicing
5 BTS 6. The message is forwarded transparently to the MSC 2, which directs the message on to the SMC 14. The SMC 14 generally holds the message and handles the onward transmission to the terminating station corresponding to the directory number specified in the SMS message by the user of the mobile station 8.

10 When switched on within coverage of the mobile network, the mobile station has two possible modes, namely idle mode and connected mode. Both of these are described in GSM Technical Specification 05.08.

In idle mode, the mobile station 8 measures radio sub-system downlink performance and signal strengths received from surrounding cells.
15 The mobile station 8 selects a preferred cell according to a cell selection algorithm, and informs the network via a signalling channel of its selection. Occasionally, when the mobile station moves to a new cell site, the mobile station transmits a location update to the mobile network via a signalling channel.

20 When in connected mode, the mobile station 8 initiates a call establishment procedure and is allotted a dedicated channel (a "connection") for the transfer of voice and/or data traffic over the radio interface. The

dedicated channel includes a main traffic channel (TCH) for carrying the voice or data traffic, and a low-rate signalling channel (the Slow Associated Control Channel, SACCH). When in connected mode, the mobile station continuously performs radio measurements from the serving cell BTS and
5 from neighbouring cell BTSs. These measurements are regularly reported to the serving cell BTS on the SACCH. The mobile station can report measurements relating to a number of candidate target cells in addition to the measurements relating to the serving cell. These measurements allow the serving BSC to decide when and where to the handover of a given mobile
10 station in connected mode is to be initiated. The BSC intercepts the measurement reports generated by the mobile station and sent on the SACCH part of the dedicated channel.

It is also possible for the mobile station 8 to send, and receive, short messages (SMS messages) when in connected mode. Such short messages are
15 then sent over the SACCH part of the dedicated channel assigned to the mobile station, and are differentiated from signalling (in particular, the measurement reporting signalling) transmitted over the SACCH by means of a different link identifier (SAPI). The signalling messages are allotted SAPI 0, whilst short messages are allotted SAPI 3. The mobile-originating short
20 messages are not intercepted by the BSC, but are transmitted to the MSC, which generally directs the short messages using the destination address in the short message header to the SMC 14.

Figure 3 schematically illustrates an embodiment of the present invention, in which re-use of GSM-type BSCs 4 and BTSs 6, as well as at least part of the GSM radio interface, is possible, whilst a distributed processing network infrastructure, using intelligent network (IN)-type
5 functionality, replaces the prior art elements associated with and including the MSC 2.

In the arrangement of this embodiment of the invention, the BSCs 4 of one connectivity provider are connected to a first service access node 100, whereas those of a second connectivity provider are connected to a second
10 service access node 102.

Each of the service access nodes 100, 102 have connections to service provision, mobility management, switching and other connection elements, not illustrated. The service access nodes 100, 102 are interconnected using an ATM link 104.

15 In addition, a service node 106 is connected to each of the service access nodes 100, 102, using signalling links. The service node 106 is provided with a database 108. The service node 106 is adapted to perform predefined handover algorithms in order to make handover decisions based on parameters stored in database 108.

20 The data stored in database 108 includes, for all currently-active subscribers in each of the areas covered by the two connectivity providers, data relating to the following:

1. Radio link quality. Radio link measurement is performed for the current downlink in the mobile station 8, and for the current uplink in the serving BTS 6. The measurements include, for example, bit error rate, delay, delay jitter, change in quality of service, link loss probability and the time
5 before link loss.

2. A list of target radio access nodes. This is needed to determine the cell to which the radio link should be handed over to. The list is accompanied by information regarding the node capacity and node occupation.

10 3. Personal subscriber profile and service information, including bandwidth requirements, quality of service requirements, access rights, priority and preference lists, environment selection, provider selection, etc.

4. Operational criteria, which include all the quasi-static parameters (congestion and load control related parameters) required to
15 identify the need for handover.

The mobile station 8 performs radio link measurements for both the serving cell and the neighbouring cells during connected mode. In addition to the mobile station being adapted for transmitting these measurements in a conventional GSM-type measurement report as signalling on the SACCH to
20 the serving BTS, the mobile station is adapted to encapsulate radio resource measurement reports in short messages which are addressed to the service node 106. The mobile-originating short message is constructed by the mobile

station 8 using an originating address/destination address header combination identifying to the service access node 100 that the short message contains radio link measurement data, instead of a user-defined short message. This ensures that the service access node 100 transmits the measurement report short message to the service node 106, rather than the short message centre (not shown) provided in the intelligent network functionality.

Furthermore, since the measurement report is encapsulated as a short message, the measurement report is not intercepted by the serving BTS/BSC, which would otherwise be the case if the measurement report were transmitted as normal signalling on the SACCH. This takes the decision to attempt a handover out of the sole control of the BSC, and allows handover decisions to be made in the service node 106.

During connected mode, the transmission of measurement reports as normal signalling on the SACCH to the serving BTS/BSC generally occurs continually, such that normal handover decisions may then be made by the BSC 4.

When the mobile station has particular requirements e.g. bandwidth and/or quality of service, the SMS-encapsulated measurement reports are transmitted by the mobile station instead of, or in addition to, the normal signalling measurement reports, so as to allow radio resource allocation decisions to be made by the service node 106.

The mobile station may be adapted to automatically transmit an SMS-encapsulated measurement report in response to detecting when predetermined service requirement criteria are met (or not met).

Alternatively or in addition, the mobile station may transmit an SMS-
5 encapsulated measurement report on receipt of a request from the service node 106. The service node transmits such a request when other predetermined service requirement criteria are met.

The service node 106 can thus, on receipt of a measurement report, make handover decisions based on parameters not available to the individual
10 BSCs, for example the personal profile and service information.

Figure 4 schematically illustrates a situation in which handover between two connectivity providers is possible, and in which the mobile terminal reports basic measurement data to the service node database 108. Mobile terminal 8 is in the vicinity of seven BTSs 6 having frequency channel
15 numbers 835, 822, 788, 821, 780, 800 and 830 respectively. The signal strength measurements (between -106dBm and -80dBm) made by the mobile terminal are converted into corresponding quality index numbers (between 0 and 26), and these quality index numbers are encapsulated, along with the Base Station Identification codes and frequency channel numbers, in a
20 mobile-originating SMS message which is transmitted automatically on the SACCH by the mobile terminal 8 to the serving BTS 6. The message is

transmitted transparently onwards through the serving BSC 4, into the network, represented by box 110, and into the service node database 108.

The measurement reporting data encapsulated in the short messages is thus sufficient to precisely identify base stations that are visible to the mobile station 8 by means of the base station identification codes, and their associated signal strengths. The service node 106 may decide, on executing a handover algorithm using this measurement data, that a handover should be executed from the serving BTS (frequency channel number 788) belonging to one connectivity provider to a second BTS (frequency channel number 800) belonging to a second connectivity provider. The handover, under instruction from the service node 106, is then performed in the network in accordance with known handover procedures.

A decision to handover a connection may be made based on criteria such as bandwidth (in the case where the mobile station has multiple bandwidth capabilities), quality of service and/or cost associated with each of the different access nodes provided by the connectivity providers. The SMS message may include data relating to the current requirements of the handset and/or the subscriber. For example, the SMS message may include identifiers for preferred connection providers, bandwidth requirements, cost limits, hardware and software version numbers of the handset, etc.

In the example described in relation to Figure 4, the measurement reports encapsulated in the SMS message contained only radio quality index

numbers for each of the BTSs in the vicinity of the mobile station. It is envisaged that other parameters useful for performing handover decisions could also, or alternatively, be encapsulated in the SMS message. For example, the data may include, for the serving cell, the time slot number, the
5 base station colour code, the global cell ID, the receive quality, the receive signal level and/or the number of neighbour cells. Similar data could be provided for each of the neighbour cells, subject to optimisation to minimise signalling load within the network.

A service node is provided in a mobile communications network
10 which collects radio link measurement reports which are transmitted to the service node by mobile stations. The mobile stations transmit the measurement reports in encapsulated form, namely in the form of SMS messages, in order to prevent the interception of the measurement report by the serving base station.

15 The service node is able to perform handover decision algorithms using the measurement reports collected from the mobile stations in order to determine appropriate radio access nodes to be allocated to the mobile stations.

It is to be mentioned that handover decisions made by the service node
20 106 need not be initiated only by the service node 106 on receipt of the SMS-encapsulated reports. A handover request may be directed by the mobile station 8 to the service node 106. In this case, when the mobile station

initiates the handover request, it encapsulates a measurement report as an SMS message directed at the service node 106, which performs the handover decision algorithm to determine which radio access node would best serve the mobile station.

5 In the above-described embodiments, the measurement report is encapsulated as a mobile-originating SMS message, to ensure that the measurement report is not intercepted by the serving BTS/BSC. It is envisaged that other modes of encapsulation would also be possible in order to prevent interception of a measurement report by the serving BTS/BSC. For
10 example, the measurement report may be carried using an envelope and/or a message discriminator recognized at the serving BTS/BSC such that the serving BTS/BSC acts as a transparent relay for the measurement report and allowing the measurement report to reach the service node 106. A unique envelope definition could be provided for the encapsulation of such a
15 measurement report which is recognised by the BTS/BSC interface in the network and by the service access node(s), such that it is directed to the service node 106.

 Furthermore, the present invention is not limited to the transmission of measurement reports to the service node 106. Alternative radio resource
20 signalling data, for example only user preferences, or user requirements or handover requests alone, could also be encapsulated and sent in a similar manner.

Although a particular mobile station has been described above as an example, the mobile stations may be any or all of:

personal digital assistants,

cellular telephones,

5 satellite telephones,

video phones,

facsimiles,

portable personal computers, etc.

It should be mentioned that the present invention is not limited to
10 arrangements in which GSM-type BSCs and BTSs are re-used. Other cellular network arrangements, in particular third generation systems, would also benefit from use of the present invention.

It is envisaged that further variations and modifications may be employed without departing from the scope of the present invention.

CLAIMS

1. A method of transmitting signalling reports from a mobile station to a serving base station in a cellular communications system comprising a network infrastructure and a plurality of base stations connected thereto, said method comprising transmitting radio measurement reports intended for use by said serving base station to allocate a radio resource to said mobile station, and transmitting a radio resource signalling report intended for use by a service node in said network infrastructure to allocate a radio resource to said mobile station.

2. A method of transmitting signalling reports from a mobile station to a cellular communications system comprising a plurality of base stations including a base station serving said mobile station via a radio link, said method comprising encapsulating a radio resource signalling report before transmission over said radio link, such as to prevent said serving base station from intercepting said radio resource signalling report.

3. A method according to claim 1 or 2, comprising encapsulating said radio resource signalling reports in the form of a mobile-originating SMS message.

4. A method according to claim 1, 2 or 3, comprising transmitting said radio resource signalling report during a dedicated channel traffic connection for said mobile station.

5 5. A method according to any preceding claim, said radio resource signalling report comprising downlink quality data measured for said serving base station.

10 6. A method according to any preceding claim, said radio resource signalling report comprising signal strength data measured for neighbouring cell base stations.

15 7. A method according to any preceding claim, said radio resource signalling data comprising data specifying the current requirements of said mobile station.

8. A method according to claim 7, said current requirements comprising bandwidth signal-to-noise ratio, radio path loss, cost and/or quality of service requirements.

9. A method according to any preceding claim, comprising transmitting said radio resource signalling report in response to a request from said cellular communications system.

5 10. A method according to any of claims 1 to 8, comprising transmitting said radio resource signalling report in response to a request from said user.

10 11. A method of transmitting radio resource signalling reports from a mobile station in a cellular communications system, comprising transmitting said reports in the form of mobile-originating SMS messages.

12. A mobile station adapted to perform the method of any of claims 1 to 11.

15

13. A cellular communications system comprising a plurality of base stations for conducting communications with mobile stations via a radio interface, and a service node for receiving radio resource signalling reports generated by mobile stations when in connected mode in said system, said
20 system being arranged to route said reports from said plurality of base stations to said service node.

14. A system according to claim 13, wherein said radio resource signalling reports comprise downlink quality data measured by said mobile stations and/or neighbour cell signal strength data measured by said mobile stations.

5

15. A system according to claim 13 or 14, wherein said radio resource signalling reports comprise data specifying bandwidth, cost and/or quality of service requirements for said mobile stations.

10

16. A system according to claim 13, 14 or 15, wherein said service node is adapted to select radio access nodes to be allocated to said mobile stations on the basis of said reports.

15

17. A system according to claim 16, wherein said service node is adapted to select radio access nodes to be allocated to said mobile stations on the basis of individual bandwidth, quality of service and/or cost requirements for said mobile stations.

20

18. A system according to any of claims 13 to 17, wherein said base stations are adapted to select radio resources to be allocated to said mobile stations on the basis of radio measurement reports received from said mobile stations.

19. A system according to any of claims 13 to 18, wherein said system is adapted to transmit a request for said one of said reports to one of said mobile stations in response to a change in the service conditions for said one mobile station.

5

20. A system according to any of claims 13 to 19, comprising means for extracting said radio resource signalling reports from SMS messages received from said mobile stations.

1 / 3

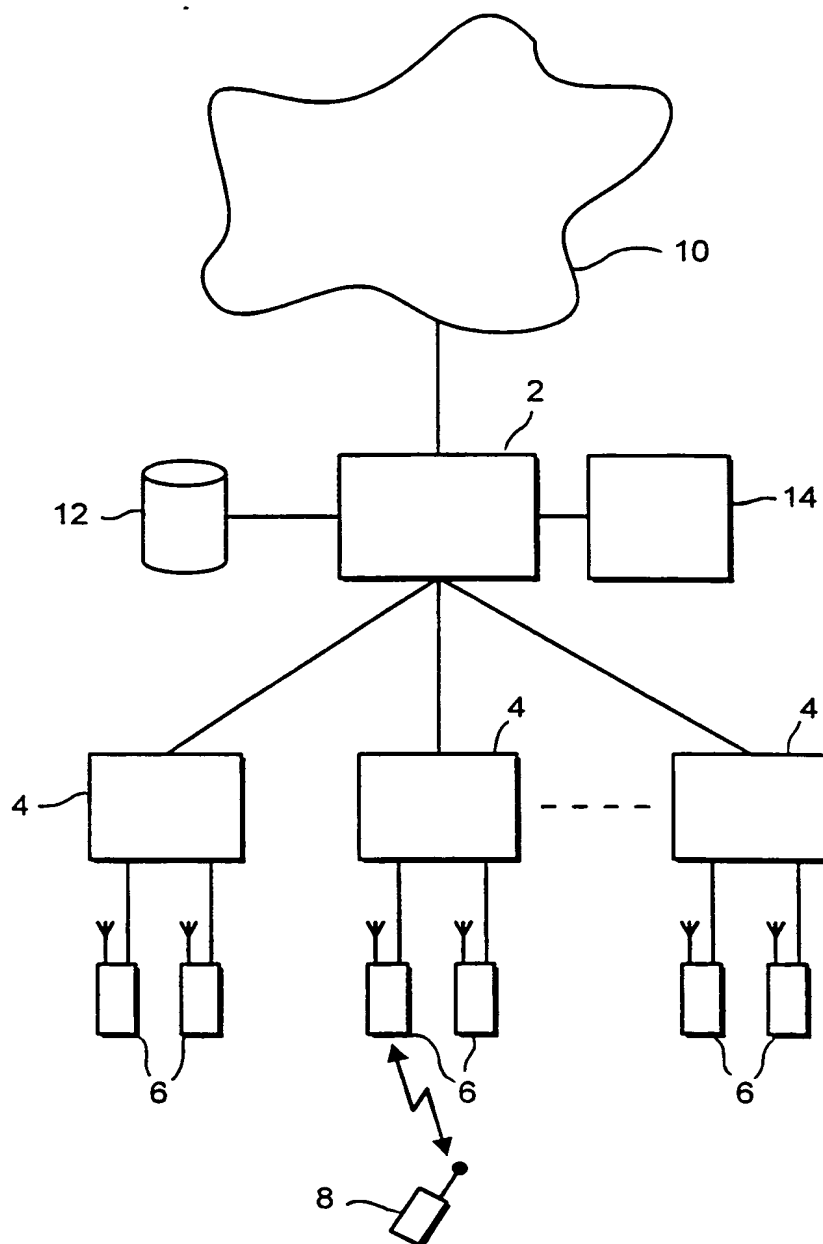


FIG. 1
(PRIOR ART)

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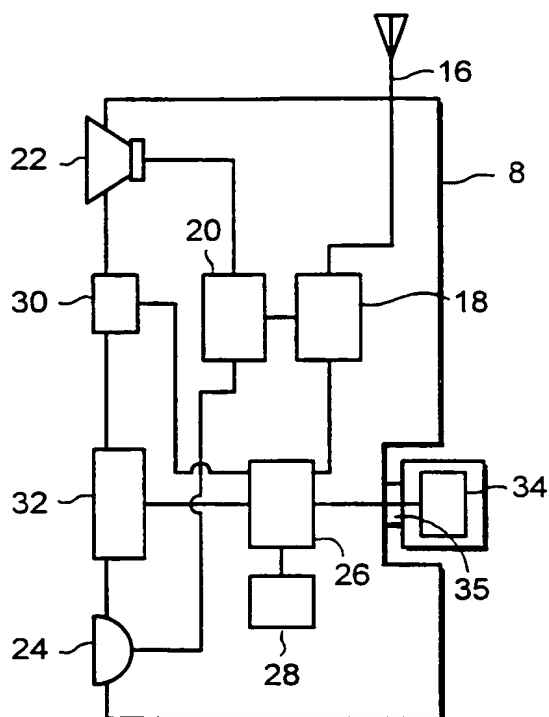


FIG. 2

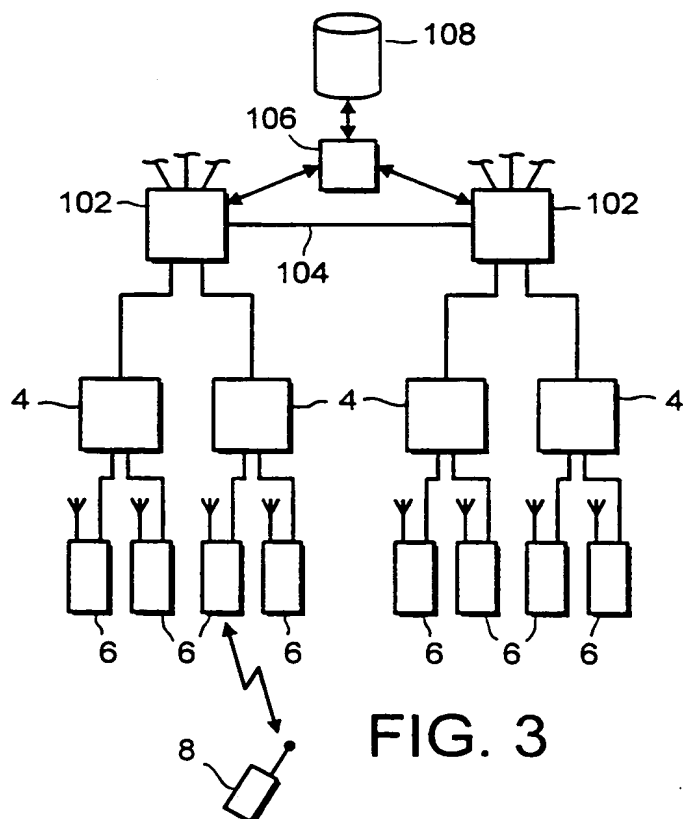


FIG. 3

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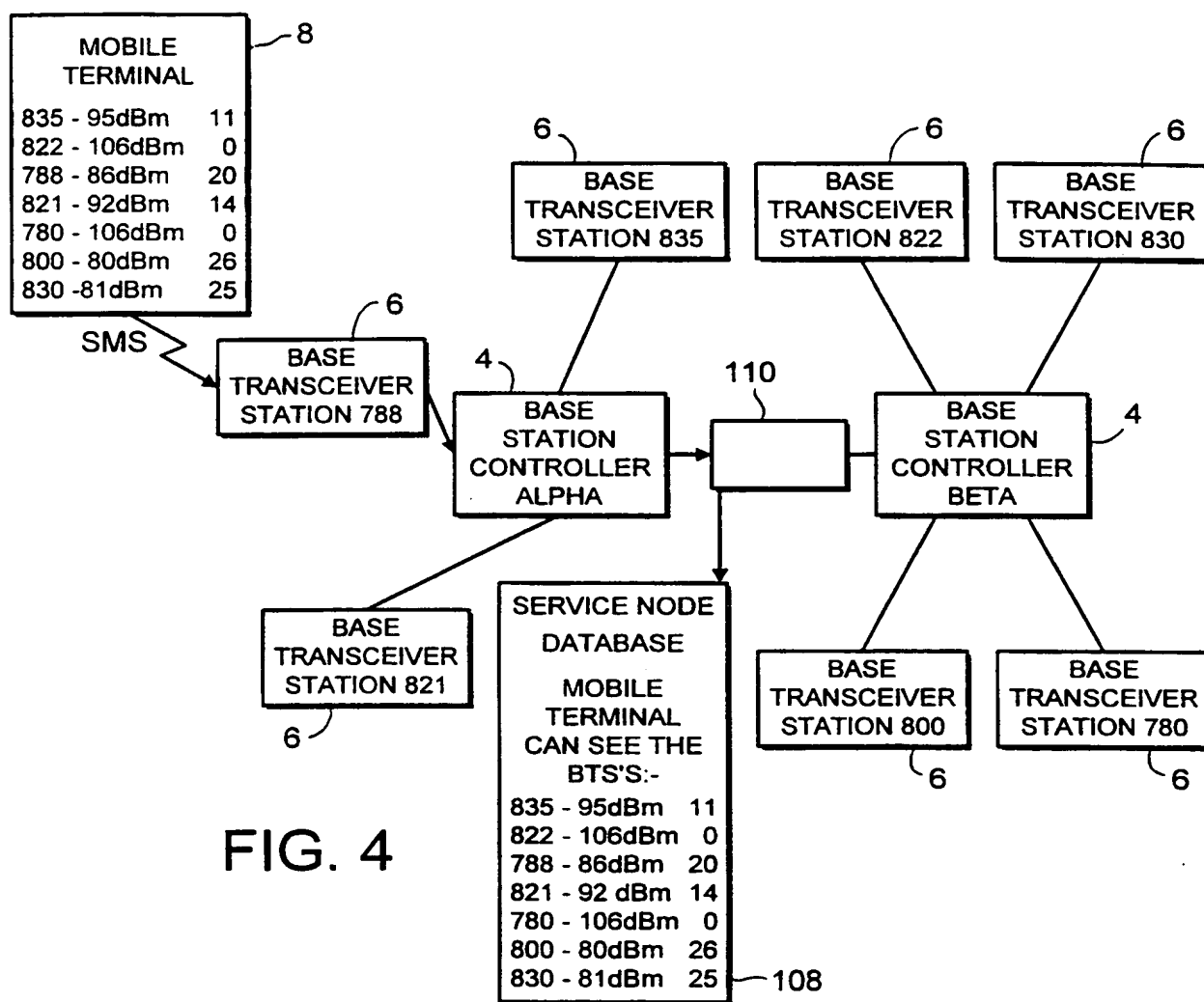


FIG. 4

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 98/03728

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 H04Q7/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|------------|---|------------------------------|
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| P,X | EP 0 851 700 A (HEWLETT PACKARD CO) 1 July 1998 see column 5, line 49 - column 6, line 27 ----- | 1-20 |

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

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- "&" document member of the same patent family

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Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Kokkoraki, A

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 98/03728

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| EP 0851700 | A | 01-07-1998 | NONE | |
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